

**Claims:** I claim

1. A multilevel hierarchical addressing and routing mechanism for high-speed Internet; the mechanism comprising:

A multilevel hierarchical view of the Internet, which is the base for grouping the IP address into short, fixed-length blocks;

A grouping of the IP address into short, fixed-length blocks based on the multilevel hierarchical view of the Internet, so that a short, fixed-length block of the IP address can be used as an index to an entry in the routing table;

An address assignment to all Internet routers based on the multilevel hierarchical view of the Internet;

A hierarchical method for an Internet router to make its packet forwarding decision based on a block of the IP address; and

An address translator at the edge of an institution's network to translate between new and old IP addresses after this institution switched to a new ISP and got a new set of IP addresses from the new ISP.

2. The mechanism of claim 1, wherein said the multilevel hierarchical view of the Internet can be created as follows:
  - a. Pick a connected group of Internet routers and assign them to the first level, called the first level routers. The number of routers at the first level depends on the Internet topology and how many levels we want to create.
  - b. Among the rest of the routers, those directly connected to one of the first level routers belong to the second level, called the second level routers. Depending on the Internet topology and how many levels we want to create, the second level can further include some routers that are directly connected to a router that is already in the second level.
  - c. Similarly, among the rest of the routers, those directly connected to one of the second level routers belong to the third level, called the third level routers. And again depending on the Internet topology and how many levels we want to create, the third level can further include some routers that are directly connected to a router that is already in the third level.
  - d. Continue this procedure until no more routers are left.

3. The mechanism of claim 1, wherein said the grouping of the IP address into short, fixed-length blocks based on the multilevel hierarchical view of the Internet can be done as follows. If there are  $n$  levels in said the multilevel hierarchical view of the Internet, we will group the IP address into  $n+1$  blocks. From left to right, the first block is corresponding to the first level of said the multilevel hierarchical view of the Internet, called the first level address. The second block is corresponding to the second level of said the multilevel hierarchical view of the Internet, called the second level address, and so on. The last block is called the interface number. The length of each block is chosen based on the number of routers in the corresponding level of said the multilevel hierarchical view of the Internet and the potential growth of that level.
4. The mechanism of claim 1, wherein said the address assignment to all Internet routers based on the multilevel hierarchical view of the Internet can be done as follows:
  - a. Each said first level router has one said first level address; we assign a said first level address to each said first level router based on the topology of the Internet.
  - b. Each said second level router has one said first level address and one said second level address; we assign a said second level address to each said second level router based on the topology of the Internet; if a said second level router is directly connected to a said first level router, this said second level router will inherit the said first level address from the connected said first level router; otherwise, this said second level router will share the same said first level address with its neighbor said second level router.
  - c. Each said third level router has one said first level address, one said second level address and one said third level address; we assign a said third level address to each said third level router based on the topology of the Internet; if a said third level router is directly connected to a said second level router, this said third level router will inherit both the said first level address and the said second level address from the connected said second level router; otherwise, this said third level router will share the same said first level address and the same said second level address with its neighbor said third level router.
  - d. Similarly, we can assign addresses for fourth level routers, fifth level routers, and so on.

5. The mechanism of claim 1, wherein said the hierarchical method for an Internet router to make its packet forwarding decision can be implemented as follows.

At said the first level, after receiving a packet a said first level router will do the following in order:

- a. If said the First Level Address block of the packet's destination address matches the router's said First Level Address, the router will forward this packet one level down to the proper said second level router based on said the Second Level Address block of the packet's destination address and skip step b.
- b. If said the First Level Address block of the packet's destination address doesn't match the router's said First Level Address, the router will forward this packet to the proper router based on said the First Level Address block of the packet's destination address.

At said the second level, after receiving a packet a said second level router will do the following in order:

- a. If said the First Level Address block of the packet's destination address doesn't match the router's said First Level Address, the router will forward this packet one level up to the proper said First Level router based on said the First Level Address block of the packet's destination address and skip steps b and c.
- b. If said the Second Level Address block of the packet's destination address matches the router's said Second Level Address, the router will forward this packet one level down to the proper said third level router based on said the Third Level Address block of the packet's destination address and skip step c.
- c. If said the Second Level Address block of the packet's destination address doesn't match the router's said Second Level Address, the router will forward this packet to the proper router based on said the Second Level Address block of the packet's destination address.

At said the third level, after receiving a packet a said third level router will do the following in order:

- a. If said the First Level Address block of the packet's destination address doesn't match the router's said First Level Address or said the Second Level Address block of the packet's destination address doesn't match the router's said Second Level

Address, the router will forward this packet one level up to a said second level router and skip steps b and c.

- b. If said the Third Level Address block of the packet's destination address matches the router's said Third Level Address, the router will forward this packet one level down to the proper said fourth level router based on the said Fourth Level Address block of the packet's destination address and skip step c.
- c. If said the Third Level Address block of the packet's destination address doesn't match the router's said Third Level Address, the router will forward this packet to the proper router based on the said Third Level Address block of the packet's destination address.

Similarly we can define the packet forwarding rules for routers at the fourth level, fifth level, and so on.

- 6. The mechanism of claim 1, wherein said the address translator at the edge of an institution's network can be implemented as follows. After switching to a new ISP, an institution can keep its old IP addresses for its hosts, and the new ISP will still assign new IP addresses for this institution. The said address translator will translate all the incoming packet's destination address to the corresponding old IP address from the new one, and translate all the outgoing packet's source address to the corresponding new IP address from the old one.